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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/036,559	12/21/2001	Alexander Kosyachkov	SMB 20959	4647

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EXAMINER	
MCDONALD, RODNEY GLENN	
ART UNIT	PAPER NUMBER
1753	5

DATE MAILED: 06/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.	Applicant(s)
10/036,559	Kosyachkov
Examiner	**Art Unit**
Rodney McDonald	1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Apr 14, 2003*.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-50* is/are pending in the application.

4a) Of the above, claim(s) *45-48* is/are withdrawn from consideration.

5) ☒ Claim(s) *23* is/are allowed.

6) ☒ Claim(s) *1-5, 13-18, 22, 24-27, 35-39, and 42-44* is/are rejected.

7) ☒ Claim(s) *6-12, 19-21, 28-34, 40, 41, 49, and 50* is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 2
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Election/Restriction

1. Applicant's election with traverse of Group I, claims 1-44, 49 and 50 in Paper No. 4 is acknowledged. The traversal is on the ground(s) that claim 46, part of Group II, is dependent upon claim 24, which is part of Group I. This is not found persuasive because claim 46 is a distinct invention (i.e. a product) which can be made by another and materially different process such as spin coating or printing.

The requirement is still deemed proper and is therefore made FINAL.

Claim Objections

2. Claims 49 and 50 are objected to because of the following informalities:

Claim 49, line 3, "with" should be "within".

Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-5, 13-18, 22, 24-27, 35-39, 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baird et al. (U.S. Pat. 4,279,726) in view of Baird et al. (U.S. Pat. 4,675,092) and Davey et al. (U.S. Pat. 4,389,295).

Baird et al. '726 teach a process for making electroluminescent films and devices by sputtering. ***Zinc sulfide, manganese (the activator), and copper sputtering targets*** are arranged in a circular configuration. RF voltages, applied to the targets, cause sputtering of the target materials. A transparent substrate with a transparent electrode formed thereon is rotated beneath the sputtering targets. An electroluminescent film including the target materials is formed on the upper surface of the transparent electrode. ***Concentration of the target materials in the electroluminescent film can be controlled by controlling the rf voltages applied to the sputtering targets.*** (See Abstract)

An apparatus for making electroluminescent films by sputtering according to the method of the present invention is illustrated in FIGS. 1 and 2. The essential components of the apparatus are shown in simplified form for ease of understanding. The electroluminescent film in the present example is zinc sulfide doped with manganese and copper. ***A zinc sulfide target 10, a manganese target 12, and a copper target 14 are placed in a vessel 16 which can be evacuated through a port 18 and filled with a suitable gas at low pressure. The gas is ionized during sputtering. One preferred gas is argon at a pressure in the range of 5 to 20 microns.*** A substrate 20 is placed on a turntable 22 which is located within the vessel 16 and is located in proximity to the targets 10, 12, and 14. In the present example, the targets 10, 12, and 14 are placed in a generally

circular configuration above the turntable 22 as shown in FIG. 2. The substrate 20 is placed at a point on the turntable 22 such that it passes beneath each of the targets 10, 12, and 14 when the turntable 22 is rotated. The substrate 20 is typically glass coated with a transparent electrode such as tin oxide or indium-tin oxide. The turntable 22 is coupled to a motor 24 external to the vessel 16 by a shaft 26. The shaft 26 passes through a vacuum-tight feedthrough 28 in the wall of the vessel 16. ***When the motor 24 is operating, it causes the turntable 22 and the substrate 20 to rotate. Thus, the substrate 20 is moved successively into proximity to the targets 10, 12, and 14 as it rotates.*** (Column 2 lines 49-68; Column 3 lines 1-9)

In operation, rf voltages are applied to the zinc sulfide target 10, the manganese target 12, and the copper target 14, thereby causing sputtering of the target materials as is well known to those skilled in the sputtering art. The substrate 20 is rotated by the motor 24 so as to pass sequentially and repeatedly underneath each of the targets 10, 12, and 14. A preferred angular speed is 5 r.p.m. As the substrate 20 passes beneath each target, a thin layer of the target material is deposited on the upper surface of the transparent electrode on the substrate 20, thereby gradually forming an electroluminescent film. Several hours of the sputtering process are required to form an electroluminescent film of about a micron in thickness. (Column 3 lines 39-52)

As noted hereinabove, the host material is zinc sulfide while the copper and manganese are dopants. Typically, the dopant levels do not exceed a few weight percent. ***The concentration of each dopant in the electroluminescent film can be controlled by varying the voltage applied to the sputtering target. When non-uniform dopant concentration is desired, the voltage applied***

to the dopant targets is varied during the sputtering process, either continuously or in steps. Alternatively, or in combination with voltage control, the dopant concentration in the electroluminescent film can be controlled by varying the area of the target exposed to the substrate. (Column 4 lines 17-29)

While the above-described process for making electroluminescent films and devices has been described in connection with zinc sulfide doped with manganese and copper, the same method is applicable to ***other host materials, for example, zinc selenide or cadmium sulfide and to other dopants, such as aluminum or rare earth elements.*** The number of sputtering targets and the material of the targets are determined by the desired composition of the electroluminescent film. Also, for greater efficiency, multiple electroluminescent devices can be simultaneously fabricated by the placement of multiple substrates on the rotating turntable. (Column 4 lines 38-49)

The differences between Baird et al. '726 and the present claims is that controlling the power ratio is not discussed, the ZnS target incorporating the activator (i.e. rare earth or manganese) is not discussed, utilizing a sulfur containing atmosphere is not discussed and the pressures are not discussed.

Baird et al. '726 discussed above teach controlling the power to the individual targets which suggest controlling the power to be within Applicant's controlled power ratio. (See Baird et al. '726 discussed above)

Baird et al.'092 teach producing a thin film electroluminescent device by forming a phosphor layer of zinc sulfide with manganese as an activator on the layer of insulating material. To form the phosphor layer electrical energy is applied to a target containing elemental zinc in an atmosphere containing hydrogen sulfide and argon to cause sputtering therefrom. Elemental zinc reacts with the hydrogen sulfide to deposit a layer of zinc sulfide over the layer of insulating material. ***The manganese is cosputtered either from a separate target or from a single target incorporating both zinc and manganese.*** (See Abstract)

The manganese may be incorporated in a single target, either by being dispersed through the target of by being alloyed with zinc. The relative amounts of zinc and manganese are chosen so that upon sputtering, the deposited phosphor film will have the desired proportion of manganese. Activators other than manganese may be employed, in particular various of the rare earth elements. Rare earth activators may also be employed with a coactivator. (Column 3 lines 4-24)

The motivation for utilizing an activator (i.e. manganese or rare earth) in a single target with zinc is that it allows for deposition of uniform, high-quality films. (Column 1 lines 61-64)

Davey et al. teach co-sputtering from two targets, one of which may be a zinc sulfide target and the other a target of manganese metal. (Column 3 lines 61-66)

The sputtering gas from the gas source may be composed of argon pre-mixed with a small percentage of hydrogen sulfide such as 1.5% to 10% hydrogen sulfide. The flow rate may be 130 sccm. The sputtering pressure is preferably on the order of 6 microns. (Falls

within Applicant's range of about 5 mTorr) Hydrogen sulfide is used in the sputtering gas to restore sulphur stoichiometry, which would other wise be deficient as the manganese target supplies no sulphur. (Column 4 lines 56-64)

The motivation for utilizing a sulfur containing atmosphere is that it restores the sulphur stoichiometry. (Column 4 lines 56-64)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Baird et al. '726 by utilizing an activator in a single target as taught by Baird et al. '092 and to have utilized a sulfur containing atmosphere for sputtering as taught by Davey et al. because it allows for deposition of uniform, high-quality films and for restoring sulfur stoichiometry.

5. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baird et al. '726 in view of Baird et al. '092 and Davey et al. as applied to claims 1-5, 13-18, 22, 24-27, 35-39, 43 and 44 above, and further in view of Kato et al. (U.S. Pat. 5,747,929).

The differences not yet discussed is the heat treatment of the electroluminescent film.

Kato et al. teach that after forming an electroluminescent layer by sputtering a thermal treatment is preferably performed. In the embodiment, thermal treatment is preferably performed for 5 minutes in an $Ar+H_2S$ atmosphere at 650 degrees C. (Column 7 lines 22-25)

The motivation for performing thermal treatment allows for the film to exhibit light emission. (Column 7 line 29)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized a heat treatment as taught by Kato et al. because it allows for producing a film that exhibits light emission.

Allowable Subject Matter

6. Claims 6-9, 10-12, 19-21, 28-31, 32-34, 40, 41 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. Claims 49 and 50 are objected to, but would be allowable if rewritten to overcome the objection to the claims.

8. Claim 23 is allowed.

9. The following is a statement of reasons for the indication of allowable subject matter:

Claims 6-9 and 28-31 are indicated as being allowable over the prior art of record because the prior art of record does not teach the method wherein a sulfur bearing compound which is an alkaline earth sulfide is utilized

Claims 10-12 and 32-34 are indicated as being allowable over the prior art of record because the prior art of record does not teach the method wherein the method produces a phosphor composition which is an alkaline earth thioaluminate phosphor film.

Claims 19-21, 40 and 41 are indicated as being allowable over the prior art of record because the prior art of record does not teach a method wherein the substrate is rotated and/or

oscillated to facilitate deposition of a laminated phosphor film that is alternately rich and poor in aluminum.

Claim 23 is allowable over the prior art of record because the prior art of record does not teach a method for depositing a film onto a substrate, said method comprising the steps of: providing a substrate having a substrate surface; depositing a rare earth activated alkaline earth thioaluminate phosphor composition over the substrate surface, the composition being a laminated film with a periodic composition alternatively rich and poor in aluminum.

Claims 49 and 50 are indicated as being allowable over the prior art of record because the prior art of record does not teach a method for preparing a thin film phosphor composition, said method comprising the steps of placing a substrate within a reactive chamber; supplying a sputtering gas mixture of hydrogen sulfide at a pressure of about $5 * 10^{-3}$ torr to the reactive chamber; applying power in a ratio of about 1:1 to 5:1 to a first source of elemental aluminum and a second source of alkaline earth sulfide; said first or second source additionally comprising an activator species selected from the group consisting of cerium and europium; wherein applying said power to said first and second sources causes sputtering thereof and a flux of atomic species of said first and second targets onto said substrate to form a thin film alkaline earth thioaluminate phosphor composition.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney McDonald whose telephone number is 703-308-3807. The examiner can normally be reached on M-Th from 8 to 5:30. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen, can be reached on (703) 308-3322. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9310.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

RODNEY G. MCDONALD
PRIMARY EXAMINER

RM

June 12, 2003